CEN 111 – Logic Design

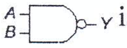
Mid Term Exam – 1

Date: 13/03/2012 **Time: 1 hour**

Name: ID:

Answer the following questions. **Total mark is 15.**

Part 1: Multiple choice questions. Each question carries 1 mark.

1. The maximum value of a 6 bit binary number (in 2's complement form) is:
   (a) 63 (b) 64 (c) 32 [✓ (d) 31]
2. 8-bit sign extended value of 1011_2 (in 2's complement form) is:
   (a) $0000\ 1011_2$ (b) $0011\ 1011_2$ [✓ (c) $1111\ 1011_2$] (d) $1011\ 1011_2$
3. The symbol  is:

   [✓ (a) NAND] (b) NOR (c) AND (d) OR
4. The min-term for the function $Y = F(A,B,C)$, where $A = 1, B = 1, C = 0$ is:
   (a) $\bar{A}+\bar{B}+C$ [✓ (b) $AB\bar{C}$] (c) $A+B+\bar{C}$ (d) $\bar{A}\bar{B}C$
5. $B+\bar{B} =$
   [✓ (a) 1] (b) 0 (c) B (d) $\bar{B}$
6. The output $Y = \bar{A}B + AB$ is TRUE when:
   (a) $A = 1, \quad B = 0$ [✓ (b) $A = 1, \quad B = 1$] (c) $A = 0, \quad B = 0$

Part 2: Short questions. Marks are shown beside each question.

7. Calculate $(-16_{10})+(-9_{10})$ by converting the decimal numbers to 6-bit two's complement binary numbers and then adding them. 2.5

$+16_{10} = 010000_2$

$-16_{10} = 101111_2 + 1_2 = 110000_2$

$+9_{10} = 001001_2$

$-9_{10} = 110110_2 + 1 = 110111_2$

$$\therefore (-16_{10})+(-9_{10}) = \begin{array}{r} 110000_2 \\ 110111_2 \\ \hline \boxed{1}100111_2 \end{array} \equiv -25_{10}$$

$\uparrow$

Overflow

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8. Write the function of *Y* in sum of products (sum of min-terms) form: 1.5

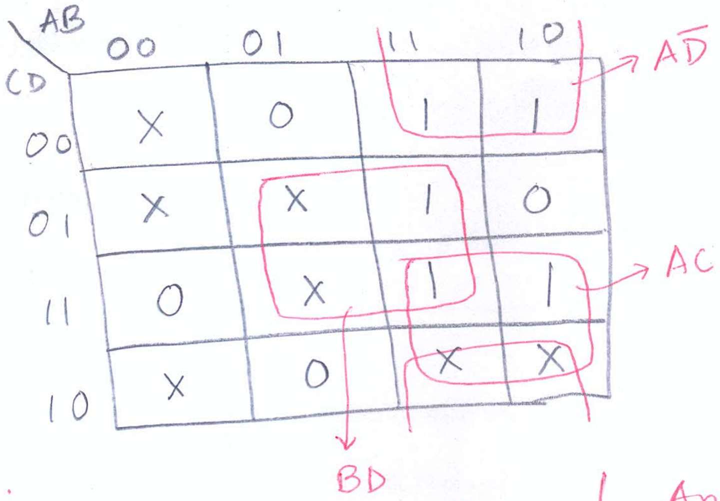
A	B	Y
0	0	1
0	1	0
1	0	1
1	1	1

A	B	Y	minterm
0	0	1	$\bar{A}\bar{B}$
0	1	0	$\bar{A}B$
1	0	1	$A\bar{B}$
1	1	1	AB

$\therefore Y = \bar{A}\bar{B} + A\bar{B} + AB$

9. Find a minimal Boolean equation for the function below using K-maps. 3

A	B	C	D	Y
0	0	0	0	X
0	0	0	1	X
0	0	1	0	X
0	0	1	1	0
0	1	0	0	0
0	1	0	1	X
0	1	1	0	0
0	1	1	1	X
1	0	0	0	1
1	0	0	1	0
1	0	1	0	X
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	X
1	1	1	1	1



CD \ AB	00	01	11	10
00	X	0	1	1
01	X	X	1	0
11	0	X	1	1
10	X	0	X	X

$\therefore Y = A\bar{D} + AC + BD$

Another solution

$Y = A(B + C + \bar{D})$

10. Implement the function from Q. 8 using a 2:4 decoder. 2